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NEOAPLECTANA CARPOCAPSAE, A NEMATODE PARASITE OF INSECTS.

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Neoaplectana carpocapsae (=Steinernema feltiae) was described from a codling moth collected in Czechoslovakia in 1954, and was found about the same time in the Eastern part of the U.S. The U.S. nematode population was called DD-136 for many years and is now known as the DD-136 strain, and the Czechoslovakian population is called the Czechoslovakian strain of N. carpocapsae. Other recognized strains are: Breton, Italian, Mexican, Agriotes, All, X-I, X-II, and X-III. Two other important species in the genus with characteristics similar to N. carpocapsae are N. bibionis and N. glaseri.

Neoaplectana carpocapsae has a reported host range of 250 insect species in 10 Orders but only seven of those species were naturally infected, the rest being experimentally infected (1). Nematodes in this genus and a related genus Heterorhabditis have a unique association with specific bacteria. N. carpocapsae is associated with the bacterium Xenorhabdus nematophilus. The third stage of the nematode is the infective stage. When the nematode reaches that stage, the mouth closes, the alimentary tract collapses around a pellet of bacteria, and the second stage cuticle is retained as a sheath. These nematodes seek an insect host and when one is encountered, the nematodes enter by way of the mouth, penetrate the gut wall and enter the body cavity. Here they prepare to molt and in the process release the bacterial pellet into the body cavity of the insect. The bacteria multiply rapidly in the haemolymph and kill the insect by blood-poisoning. The nematodes feed on the bacteria and molt twice to become adults. Males and females, which are quite large, mate and females produce eggs. Most of the juveniles which hatch from these eggs mature to become much smaller adult males and females than the first generation. Again, mating occurs and eggs are produced. In the meantime, the insect has died and most of its body contents have been digested. Thus, the shortage of food causes the juveniles which hatch from the eggs laid by the second generation adults to stop development as third stage juveniles and leave the insect cadaver in search of a new host. One insect cadaver can produce from 50,000 to 2000,000 infective-stage juveniles. The nematodes can be grown in vitro as well as in vivo.

The long list of insect hosts reported for N. carpocapsae has stimulated considerable biocontrol research. Field trials have been conducted in attempts to control some 39 insects, including the Colorado potato beetle, tobacco budworm, codling moth, cabbage root maggot, corn earworm, white-fringed beetle, onion borer, pecan weevil, and wireworms. Some of the trials were very successful but limited commercial development has occurred because of a relatively short "shelf life" of the nematode. Improvement appears to be imminent, however.

We have imported to Florida from Uruguay a strain of N. carpocapsae which is very specific to mole crickets in attempts to control mole crickets accidentally introduced here. In laboratory tests, we obtain 95-100% kill of mole crickets, and in field trials up to 50% kill with the initial release and about 10% kill thereafter. Currently, we are searching for the best methods of distributing the nematode in nature, and trying to determine how long the nematode will survive in sufficient numbers to provide adequate levels of control (Figs. 1, 2, 3).

LITERATURE CITED:

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Fig. 1. Neoaplectana carpocapsae. The whitish film on the surface of the mole cricket cadavers is comprised of juvenile and adult nematodes which developed in the mole crickets.

Fig. 2. Neoaplectana carpocapsae which have emerged from a mole cricket cadaver. The larger nematodes are adults and the smaller ones are third-stage infective juveniles. About 20,000 infective-stage juveniles develop in one mole cricket cadaver. Note large numbers of nematodes in dish containing the mole cricket.

Fig. 3. Neoaplectana carpocapsae. Different life stages of the nematode. The largest specimen is a first generation female, the next largest is a second generation female and the smaller ones are third-stage juveniles.